Strategic Astrophysics Technology

High Performance Sealed Tube Cross Strip Photon Counting Sensors for UV-Vis Astrophysics Instruments

Completed Technology Project (2018 - 2020)

Project Introduction

The objective of this program is to exploit the developments in atomic layer deposited (ALD) microchannel plates (MCPs), photocathodes and cross strip (XS) readout techniques to provide a new generation of enhanced performance sealed tube photon counting sensors that span the 115nm to 400nm regime. Efforts in all the subcomponent areas have achieved considerable technical development and heritage, but putting them into a robust integrated package with advanced TRL for the next UV-Vis Astrophysics instruments has not been done to date. Component developments include ALD MCP formats up to 127 x 127 mm with 10 µm pores, background rates of ~0.05 events/cm2/sec, and extended lifetimes to >10 C/cm2. XS anodes and electronics have shown spatial resolutions of <18µm FWHM over formats of 100 x 100mm and event handling rates of 5 MHz at <15% dead time. Photocathodes in the FUV can achieve 50% quantum efficiency at ~115nm and 30% at 200-300nm with cutoffs above 400nm. Combining these developments has a significant impact to potential future NASA sub-orbital and satellite instruments. These advancements will enable high spatial resolution improvements to MCP based spaceflight detectors for imaging and spectroscopic instruments from small to large (>10 cm) formats in the UV to Visible regimes. The smaller pore sizes (~10 µm) and high resolution XS readouts will facilitate higher spatial resolutions over the large formats. At the same time the reduced (÷3) detection efficiency for high-energy background events demonstrated by use of ALD MCPs will also improve observational sensitivities. The chemical compatibility of the new MCP borosilicate glass and the ALD materials has the potential to provide further improvements in the stability and lifetime of these detectors due to the rigorous pre-conditioning steps for sealed tubes. In addition, improvements in fabrication processes provide the opportunity to reduce the imaging fixed pattern modulation and thermal resistance changes. XS readouts integrated into sealed tube packages can also fully take advantage of the efforts currently taking place to establish high performance, spaceflight compatible, low power-mass-volume ASIC readout electronics. These developments will together provide a significant step in the realization of high performance, robust, MCP detectors for the next generations of UV Astrophysics instruments.

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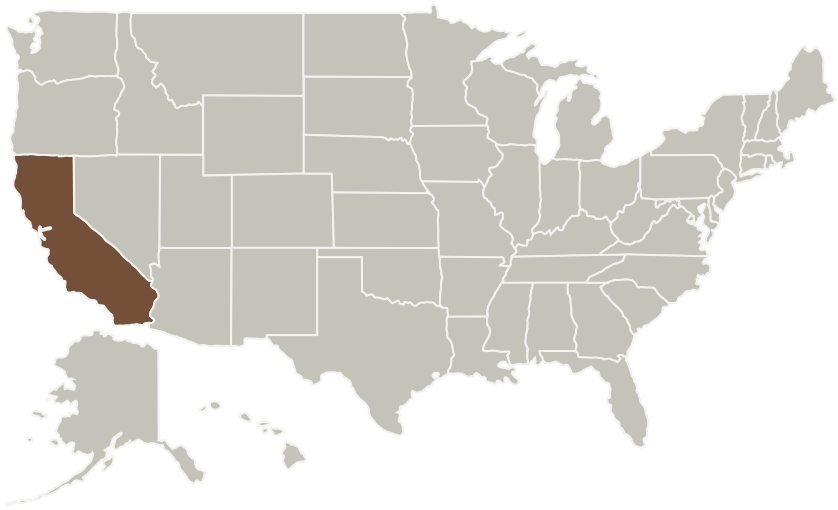
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Regents of the University of California	Lead Organization	Academia	Oakland, California
UC Berkeley Space Science Laboratory	Supporting Organization	Academia	Berkeley, California
University of California-Berkeley(Berkeley)	Supporting Organization	Academia	Berkeley, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

Regents of the University of California

Responsible Program:

Strategic Astrophysics Technology

Project Management

Program Director:

Mario R Perez

Program Manager:

Mario R Perez

Principal Investigator:

Oswald Siegmund

Co-Investigators:

Joyce So
Camden Ertley

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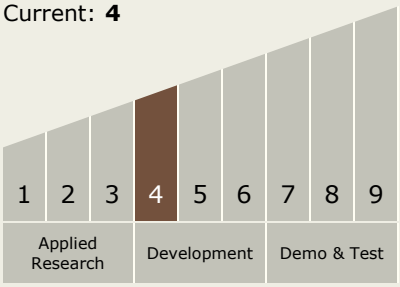
Technology Maturity (TRL)

Start: **4**
Current: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System